The opinion in support of the decision being entered today
is *not* binding precedent of the Board

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES

Ex parte JOHN MACNEIL,
KNUT BEEKMAN, and ANTHONY PAUL WILBY

Appeal 2006-3024
Application 09/914,204
Technology Center 1700

Decided: June 28, 2007

Before CHARLES F. WARREN, CATHERINE Q. TIMM, and
JEFFREY T. SMITH, *Administrative Patent Judges.*

WARREN, *Administrative Patent Judge.*

DECISION ON APPEAL

Applicants appeal to the Board from the decision of the Primary Examiner rejecting for at least the second time claims 1, 3, 5, and 10 through 26 in the Office action mailed July 15, 2005. 35 U.S.C. §§ 6 and 134(a) (2002); 37 C.F.R. § 41.31(a) (2005).

We affirm the decision of the Primary Examiner.

Claim 1 illustrates Appellants' invention of a method of processing a polymer layer including Si-C bonds, and is representative of the claims on appeal:

1. A method of processing a polymer layer including Si-C bonds including the steps of heating the layer to desorb moisture and harden the layer and exposing the layer to a hydrogen plasma during the heating process, wherein the polymer layer includes carbon subsequent to said heating and exposing, and wherein the layer is supported on an electrode and the plasma is at least partially maintained by an RF power source connected to the electrode.

The Examiner relies on the evidence in these references:[1]

Tsukune	US 5,314,724	May 24, 1994
Tamura	US 5,897,923	Apr. 27, 1999
Domoto	US 6,354,008 B1	Mar. 12, 2002
Li	US 6,383,951 B1	May 7, 2002
Beekman	US 6,544,858 B1	Aug. 18, 2000

Appellants request review of the following grounds of rejection under 35 U.S.C. § 103(a) (Br.[2] 10), all advanced on appeal:

claims 1, 3, 5, and 10 through 26 as unpatentable over Li in view of Tamura and Tsukune (Answer 4-9); and

claims 1, 3, 5, and 10 through 26 as unpatentable over Tsukune in view of Domoto, Li, and Tamura (*id.* 9-14).

The Examiner also advances the ground of rejection of claims 1, 3, 5, and 10 through 20 under the judicially created doctrine of obviousness-type double patenting as unpatentable over patent claims 1 through 3, 7, 8, 15, 29, and 31 of Beekman in view of Tsukune (Answer 3-4).

---

[1] We have not considered the three United States Patents listed at pages 3 and 14 of the Answer as "not relied upon . . . [but] considered pertinent."
[2] We consider the Brief filed April 4, 2006.

Appellants argue the independent claims in each ground of rejection under § 103(a) and further argue dependent claim 26 with respect to the first ground and dependent claims 14 and 26 with respect to the second ground, advancing no separate argument with respect to the remaining claims (Br. in entirety). Thus, we decide this appeal with respect to the grounds of rejection under § 103(a) based on claims 1, 14, 21, 22, and 26. 37 C.F.R. § 41.37(c)(1)(vii) (2005).

With respect to the ground of rejection based on the combined teachings of Li, Tsukune, and Tamura, the Examiner contends Li discloses a method for processing a polymer layer which includes Si-C bonds and is deposited on a wafer substrate from an organosilane and an oxygen source, comprising the steps of treating the layer with an oxygen plasma while heating the layer to desorb moisture, thus preparing a layer having a dielectric constant (k) below 3.00 (Answer 5). The Examiner contends RF power is applied to the electrodes of a conventional plasma reactor used for the film deposition and plasma treatment, and the substrate with the layer thereon is supported on a platen electrode that has a resistive heating element (*id.*). The Examiner contends it would have been prima facie obvious to employ the conventional plasma treatment apparatus disclosed by Tamura, which has a high-frequency power source 44 connected to substrate holder electrode 42 that includes a thermo control structure 43, as the reactor of Li (*id.* 5-6, citing Tamura col. 1, ll. 11-67, and Fig. 12; *see also* 16-17).

The Examiner contends Tsukune discloses a method for converting a silanol film to a silicon oxide layer by treatment with functionally

equivalent hydrogen plasma or oxygen plasma at a high temperature to remove organic groups and water from the film. Thus, the Examiner concludes it would have been prima facie obvious to use a hydrogen plasma instead of the equivalent oxygen plasma in the process of Li (Answer 6-7; *see also* 16). The Examiner contends one of ordinary skill in the art would have had a reasonable expectation of success in using a hydrogen plasma instead of an oxygen plasma because the same are applied for substantially identical time and temperature ranges to silanol layers, which are further hardened under heating (*id.* 7). The Examiner contends Li teaches inductively coupled plasma (ICP) mode and thus one of ordinary skill in thus art would have used the ICP mode with the reactive ion etch (RIE) plasma mode as required by claims 22 and 26 (*id.* 7-8). The Examiner contends one of ordinary skill in this art following the teachings of the references would have determined optimum variables such as film thickness required by claim 21 by routine experimentation, and the film would inherently have a dielectric constant below 3.00 as required by claim 14 (*id.* 8-9).

With respect to the ground of rejection based on the combined teachings of Tsukune, Domoto, Li, and Tamura, the Examiner contends Tsukune discloses a method for processing a polymer layer including Si-C bonds deposited on a wafer substrate from an organosilane and H_2O, by treating the layer with a hydrogen plasma to remove organic groups while heating to accelerate crosslinking and desorbing moisture to convert the layer to a silicon oxide layer, wherein the plasma assisted deposition of the layer and the plasma post-treatment thereof are carried out in the same

chamber (Answer 9-10). The Examiner contends it would have been prima facie obvious to use the plasma reactor having a substrate holder or platen 77 electrically connected to RF power source 83 taught in Domoto or the plasma reactor of Tamura (*see above* p. 3) as the reactor of Tsukune (*id.* 10-11, citing Domoto col. 1, ll. 44-53, col. 23, ll. 19-27, and Fig. 25; *see also* Answer 17-18). The Examiner concludes it would have been prima facie obvious to conduct the process of Tsukune using the process conditions described by Li since Tsukune teaches the equivalence of hydrogen plasma and oxygen plasma with the expectation of obtaining a layer as taught by Li (*id.* 11-12). The Examiner presents substantially the same contentions with respect to claims 14, 21, 22, and 26 (*id.* 12-13). The Examiner contends the polymer layer prepared according to the teachings of the references "would still include some or even traces of carbon (i.e. Si-C bonds) because: (i) it is generally impossible to completely remove every possible Si-C bond; and (ii)" the process conditions of Li are "somewhat '*milder*'" than the hydrogen plasma treatment of the claimed invention thus leaving some carbon, and "Li teaches that the oxygen plasma treatment leaves some carbon" (*id.* 13-14; *see also* 15-16).

With respect to the ground of rejection based on the combined teachings of Li, Tsukune, and Tamura, Appellants contend one of ordinary skill in this art would not have modified Li by the teachings of Tsukune because Li retains carbon in the film for low-k dielectric properties and Tsukune removes carbon with a hydrogen plasma treatment and does not teach the equivalence of hydrogen plasma and oxygen plasma (Br. 15-16). Appellants contend Tsukune's process removes all the carbon and describes

thin films of 1000Å or less which are laid one on top of the other (*id.*). Appellants contend Tsukune would not lead one of ordinary skill to substitute hydrogen plasma for the plasma from source gases containing nitrogen and/or oxygen used by Li to avoid deposition of an oxynitride layer, and would not suggest a hydrogen plasma would drive water out of the silanol layer in Li's process (*id.* 16). Appellants contend there is no disclosure in the references which would suggest modifying Li's process to include the RF driven polymer layer supporting electrode required by claims 1 and 21 and the RIE plasma mode required by claim 22 by the disclosure in Tamura of an RF driven platen electrode (*id.* 16-18). In this respect, Appellants contend one of ordinary skill would consider that "RIE plasma processing is a relatively 'rough' process . . . in which an RF driven platen is utilized to forcibly drive the plasma into the upper surface of the substrate" and "would not be substituted for an ICP . . . plasma" (*id.* 18).

With respect to the ground of rejection based on the combined teachings of Tsukune, Domoto, Li, and Tamura, Appellants contend one of ordinary skill in this art would not have modified the process of Tsukune by using Li's processing conditions (Br. 19-20). Appellants here advance the same contentions with respect to the teachings of Li and Tsukune advanced with respect to the previous ground of rejection, and further contend the references would not suggest modifying Tsukune's process to include an RF driven platen electrode as well as ICP and RIE plasma modes (*id.* 20 and 22). Appellants contend the Examiner cites no authority for the proposition that it is generally impossible to completely remove every Si-C bond from the film prepared according to the applied references (*id.* 21). Appellants

contend it would not have been obvious to modify Tsukune's process to treat a film having a thickness of 7,000-9,000Å as required in claim 21, and Tsukune's formation of a silicon dioxide layer "teaches away from an organic polymer layer having a dielectric constant of less then 3.00" as required in claim 14.

The issues in this appeal are whether the Examiner has carried the burden of establishing a prima facie case of obviousness of the claimed invention encompassed by claims 1, 14, 21, 22, and 26 over the combined teachings of Li, Tsukune, and Tamara, and this combination as further combined with Domoto.

The plain language of independent claim 1 specifies any method of processing any manner of polymer layer containing any amount of Si-C bonds, however small, that includes at least the steps of (1) heating the layer, to desorb moisture and harden the layer, and (2) exposing the layer to any manner of hydrogen plasma during the heating process, wherein the layer is supported on an electrode to which is connected an RF power source that at least partially maintains the hydrogen plasma. We thus determine that the polymer layer to be treated "is supported [directly] on an electrode" or is deposited on a wafer and "supported [indirectly] on an electrode" in this manner (*see* Specification, e.g., 3:6-8). The transitional term "including" opens the claim to encompass processes having any manner of additional steps, reactants and reaction conditions, such as the presence of other ions or radicals in the hydrogen plasma. *See, e.g., In re Bertsch*, 132 F.2d 1014, 1019, 56 USPQ 379, 384 (CCPA 1942) ("it is true that the word 'comprising' is usually in patent law held to be synonymous

with the word 'including'"); *Ex parte Davis*, 80 USPQ 448, 449 (Bd. App. 1948) ("the word 'comprising' alone being synonymous with 'including'"); *cf. Exxon Chem. Pats., Inc. v. Lubrizol Corp.*, 64 F.3d 1553, 1555, 35 USPQ2d 1801, 1802 (Fed. Cir. 1995) ("The claimed composition is defined as comprising - meaning containing at least - five specific ingredients."); *In re Baxter*, 656 F.2d 679, 686-87, 210 USPQ 795, 802-03 (CCPA 1981) ("As long as one of the monomers in the reaction is propylene, any other monomer may be present, because the term 'comprises' permits the *inclusion* of other steps, elements, or materials.").

The polymer layer resulting from the required two steps is specified in claim 1 to include any manner of carbon in any amount, regardless of bonding, and to further have a dielectric constant below 3.00 in dependent claim 14. Independent claim 21 has essentially the same limitations as claim 1 and further includes the limitation that the layer formed has a thickness of 7,000Å to 9,000Å. Independent claim 22 specifies that the "hydrogen plasma is generated in an [RIE] mode," with dependent claim 26 further adding the limitation the hydrogen plasma is generated in an ICP mode concurrently with the RIE plasma mode. Appellants disclose with respect to the RIE plasma mode that "[t]he plasma may be maintained by the wafer support RF driven electrode on which the layer is supported e.g. indirectly on a semiconductor wafer reactor electrode (sometimes known as Reactive Ion Etch (RIE) mode even if no etching occurs)" (Specification 3:6-10). In view of this disclosure, we interpret the RIE plasma mode requirement in claims 22 and 26 to permit the inclusion of embodiments where the polymer layer is merely supported on a wafer support RF driven

electrode. In this respect, claim 22 has substantially the same limitations as claim 1.

We find Li would have disclosed to one of ordinary skill in this art a method wherein an organosilane gas source is reacted with an oxidizing agent to form a layer predominately of silicon hydroxide which incorporates carbon, plasma treating the silicon hydroxide layer without formation of a cap layer, and annealing the silicon hydroxide to drive off water, thus forming an insulating layer which includes a polysiloxane network that incorporates carbon-silicon bonding or carbon and has a dielectric constant less than about 3.3 (Li, e.g., col. 1, l. 65, to col. 2, l. 39, and col. 6, ll. 3-10). The organosilane can be an alkylsilane providing Si-C bonds, such as methylsilane (SiH_3CH_3) which provides incorporated carbon in the form of methyl groups ($-CH_3$); the oxidizing agent can be hydrogen peroxide (H_2O_2); and the silicon hydroxide ($Si(OH)_4$) produced is also known as silanol or "flowfill oxide" (*id.*, e.g., col. 4, ll. 19-41 and 59-66, and Fig. 2). The process parameters for depositing the silanol film depend on, among other things, the desired dielectric constant and layer thickness (*id.*, e.g., col. 4, ll. 42-58). The deposited silanol layer is characterized as predominately $Si(OH)_4$ with "[p]referably, about 5% to 20% of the silicon atoms in the silicon hydroxide . . . associated with a carbon atom" (*id.*, e.g., col. 4, l. 62, to col. 5, l. 6, col. 7, ll. 41-46).

The silanol layer is treated with a plasma which does not deposit an appreciable layer thereover, and "preferably includes an oxygen component therein, preferably from source gases such as O_2, O_3, N_2O, N_2O/N_2 or combinations thereof" (Li, e.g., col. 5, ll. 6-16). The plasma can be

established with "RF power sufficient to disassociate the constituent gases . . . applied to the electrodes of a plasma reactor" and with "ionizing power . . . coupled to the gas by way of microwave plasma or [ICP]," the process parameters depending on the source gas and the plasma mode employed (*id.*, e.g., col. 5, ll. 16-42). The plasma treated silanol layer is subjected to a thermal anneal which can be performed simultaneously with the plasma treatment, preferably at higher than 400°C and lower than 800°C "depending on the particular application for the low k material" as interlayer insulating layers (*id.*, e.g., col. 5, l. 43, to col. 6, l. 2). "[T]he post-deposition treatment drives water out of the silanol layer, leaving a polysiloxane network incorporating carbon-to-silicon bonding" (*id.*, e.g., col. 6, ll. 3-10, and col. 7, ll. 47-52). The plasma and high temperature anneal post-treatments can both lower the dielectric constant of the material, which can be less than about 3.0 particularly when annealed within the preferred temperature range as illustrated in Fig. 9B (*id.*, e.g., col. 6, l. 5, to col. 7, l. 6, and Figs. 9A-B). "[T]he low k dielectric material . . . is chemically very similar to silicon dioxide" and thus, "standard oxide etch chemistries, such as fluorocarbon plasma etches, can be used to etch" (*id.*, e.g., col. 7, l. 59, to col. 8, l. 4).

We find Tsukune would have disclosed to one of ordinary skill in this art methods wherein planarized interlayer insulation films of silicon dioxide (SiO_2) of the desired thickness are prepared by exciting a gas comprising an organosilane or an organosiloxane and a gas containing H and OH in a planar-type CVD system with applied RF power to deposit a thin film of organic group containing silanol, silanol polymer or siloxane-bonded

polymer, and removing the organic groups from the film, preferably by a plasma treatment and further high temperature heat treatment to also make the film dense, wherein the deposition step and the plasma treating step can be alternately repeated in the same reaction chamber (Tsukune, e.g., Abstract, col. 1, l. 51, to col. 2, l. 25, col. 6, ll. 6-9 and 22-39, and col. 7, ll. 15-33). The process parameters are controlled to form the silanol film and remove organic groups therefrom, and the incorporation of a plasma treatment and a heat treatment in the SiO_2 film forming process increases film thickness, flatness and quality (*id.*, e.g., col. 2, ll. 4-25, col. 6, ll. 39-47, col. 8, l. 18, to col. 10, l. 24, col. 14, ll. 5-32, and the Examples).

The deposition gases can be organosilanes, such as alkylsilanes including tetramethylsilane ($Si(CH_3)_4$), which provide Si-C bonds, or organosiloxanes, such as tetraethoxysilane ($Si(OC_2H_5)_4$), termed TEOS, which provide Si-O-C bonds. The compounds generating H and OH ions and radicals can be water (H_2O) and hydrogen peroxide (H_2O_2) and other radicals or ions (Tsukune, e.g., col. 8, ll. 1-9, col. 8, l. 55, to col. 10, l. 23, and Figs. 6A-B). The reaction between an organosilane or an organosiloxane with compounds generating H and OH is illustrated with TEOS and H_2O (*id.*, e.g., col. 9, l. 5, to col. 10. l. 23, and Figs. 6A-B; *see also* col. 13, l. 27, to col. 14, l. 4). The amount of organic groups in the deposited thin silanol film can be 10% or less by weight to 90% by weight depending on formation temperature, and the organic groups remain within or on the surface of the film (*id.*, e.g., col. 10, ll. 24-66, and Figs. 6A-B). A temperature increase accelerates the polymerizing "cross-linking reaction through a dehydration condensation reaction, thereby causing the Si-OH

bond to be converted to a silicon oxide having a siloxane bond (-Si-O-Si-)" (*id.*, e.g., col. 9, ll. 22-43, and col. 10, ll. 49-66). The removal of the organic groups from the silanol film and an increase of the density of the film is preferably accomplished by a plasma treatment followed by a heat treatment of 100°C to about 850°C (*id.*, e.g., col. 10, l, 67, to col. 11, l. 33). The thin film of silicon oxide can be subjected to an etch back step in the same planar-type plasma CVD system apparatus using fluorine chemistries (*id.*, e.g., col. 15, ll. 28-34).

Tsukune's preferred method involves repeating the steps of depositing the thin silanol layer and plasma treating the layer to remove organic groups in the same reaction chamber, wherein "[t]he plasma treatment can be conducted by stopping the supply of an organosilane . . . gas . . . and generating a plasma through the use of a compound containing H and OH or the introduction of other gases such as O_2, H_2, etc." (Tsukune, e.g., col. 11, l. 67, to col. 12, l. 27). Tsukune teaches "[t]he repetition of the alternating steps of the deposition of an organic-group-containing silicon oxide film and the plasma treatment makes it possible to form a planar silicon oxide film wherein the occurrence of cracking . . . has been prevented" which enables the thickness of the film to be increased to, generally, 100 nm, that is, 1,000Å, or less (*id.*, e.g., col. 12, ll. 27-43; *see also* col. 10, ll. 57-66, and col. 13, ll. 55-64).

Tsukune's Fifth Example illustrates a process in which the step of RF driven plasma deposition of an organic-group-containing silicon oxide film from the organosiloxane TEOS and H_2O and the step of RF driven O_2 plasma treatment were alternatively repeated in the same chamber. An

organic-group-containing silicon oxide film of about 100 nm was formed and the O_2 plasma treatment removed the organic component (confirmed by FTIR) without cracking the film. Six repetitions of the steps resulted in a planar thin film of silicon oxide having a thickness of 1,000 nm, that is, 10,000Å, or more (Tsukune, e.g., col. 20, l. 36, to col. 21, l. 15 *see also* col. 10, ll. 57-66, and col. 13, ll. 55-64). In the planar type (anode couple) plasma CVD system employed in this Example, the RF driven electrode is opposite the electrode supporting the wafer on which the film is deposited, which is the same system design feature of other illustrated reactors (*id.*, e.g., col. 20, ll. 36-39, col. 14, ll. 5-29, col. 17, ll. 59-63, and Figs. 13, 16A-B, and 27; *see also* col. 25, l. 52, to col. 26, l. 1, and Fig. 30A).

Tsukune's Seventh Example illustrates a number of processes. In one process, an RF driven plasma deposition of an organic-group-containing silicon oxide film from the organosiloxane TEOS and H_2O was conducted for 5 seconds, wherein the organic-group-containing silicon oxide film of about 100 nm was formed and H_2O plasma treated for one minute and annealed at 250°C and 400°C. "[T]he organic component in the film is reduced by the H_2O plasma treatment to substantially zero" as established by infrared absorption spectrum of the film (Tsukune, e.g., col. 22, l. 63, to col. 23, l. 11, and Fig. 24). In a repeat process involving the same and similar steps to the above process but at increased RF power in the H_2O plasma treatment, cracking occurred during annealing, which Tsukune believed was caused by the increased RF power rapidly modifying the surfaces of the film such that "a dense silicon oxide film is formed on the

surface of the film before the organic group within the film is decomposed and removed by the H_2O plasma treatment" (*id.*, e.g., col. 24, ll. 34-59).

We find Tamura would have acknowledged a plasma-assisted CVD apparatus known in the art for forming silicon dioxide films using O_2 and monosilane (SiH_4) wherein substrate holder 42 has structure 43 for circulating a thermo-exchange medium and is connected to a high-frequency power source 44 which applies biased voltage thereto (Tamura col. 1, ll. 13-67, and Fig. 12). Tamura teaches the same arrangement in the disclosed plasma treatment devices wherein the high-frequency power source is an RF power source (*id.*, e.g., col. 4, l. 66, to col. 5, l. 35, and Fig. 1).

We find Domoto would have disclosed to one of ordinary skill in this art methods of forming a thin film with a plasma CVD apparatus having a RF power source 83 connected to substrate holder 77 (Domoto, e.g., col. 21, ll. 29-55, col. 23, ll. 17-27, and Figs. 25 and 29). A similar apparatus having RF power source 40 connected to substrate holder 37 also causes the substrate to generate a self-bias voltage (*id.*, e.g., col. 14, l. 52, to col. 15, l. 15, and Fig. 10).

We determine the combined teachings of Li, Tsukune, and Tamura and as further combined with Domoto, the scope of which we determined above, provide convincing evidence supporting the Examiner's case that the claimed method of processing a polymer layer including Si-C bonds encompassed by claims 1, 14, 21, 22, and 26, as we interpreted these claims above, would have been prima facie obviousness to one of ordinary skill in the integrated circuit fabrication arts familiar with formation of low

dielectric constant insulating layers of polysiloxane network incorporating carbon-silicon bonds or of silicon oxide substantially or completely carbon free silicon oxide.

We agree with the Examiner that prima facie one of ordinary skill in this art would have combined the teachings of Li and Tsukune and thence would have been led to substitute a hydrogen plasma for an O_2 plasma in the plasma post-treatment step of Li's methods as suggested by Tsukune in the reasonable expectation that hydrogen plasmas can be used to process a polymer layer containing Si-C bonds in converting the layer to a hardened layer that includes carbon from which moisture has been desorbed, as specified in claim 1, in the same or similar manner as oxygen plasmas. Indeed, each of Li and Tsukune prepare a silanol layer containing Si-C bonds from organosilane and oxidizing agent source gases in the same manner, wherein the silanol layers can contain Si-C bonds in ranges of amounts which reasonably appear to overlap. Each of Li and Tsukune then treat the silanol layer with plasma and concurrent heat treatment which results in desorbing water from and hardening the silanol layer in forming a polysiloxane layer. Indeed, Li discloses driving water out of the silanol layer and Tsukune discloses that polymerization forming siloxane bonds involves a dehydration condensation reaction.

We recognize that Li conducts the plasma and heat post-treatment to retain some carbon in the polysiloxane layer while Tsukune conducts such post-treatment with the intent to remove carbon from that layer. However, Tsukune discloses examples in which it reasonably appears that at least some carbon is retained, and indeed, as the Examiner contends, there is no

disclosure in Tsukune of a specific post-treatment process parameter or step that necessarily removes all of the carbon, including the type of plasma post-treatment employed. Thus, we determine that one of ordinary skill in this art would appreciate from Tsukune's disclosure that an H_2O plasma generates H and OH ions and radicals and can be used in similar manner to H_2 and O_2 plasmas, that these plasmas can be used in post-treatment steps resulting in polysiloxane layers containing carbon in the same manner that O_2 plasmas are used by Li in post-treatment steps to achieve the same and similar results. Indeed, Li does not limit the plasmas used in the post-treatment steps to only the disclosed preferred plasmas.

Thus, on this record, we agree with the Examiner that one of ordinary skill in this art would have used a hydrogen plasma as taught by Tsukune in place of the O_2 plasmas in Li's processes in the reasonable expectation of obtaining the identical or substantially identical polysiloxane layer containing carbon taught by Li. *See, e.g., In re Siebentritt*, 372 F.2d 566, 567-68, 152 USPQ 618, 619 (CCPA 1967) (express suggestion to interchange methods which achieve the same or similar results is not necessary to establish obviousness); *see also In re O'Farrell*, 853 F.2d 894, 903-04, 7 USPQ2d 1673, 1680-81 (Fed. Cir. 1988) ("For obviousness under § 103, all that is required is a reasonable expectation of success." (Citations omitted)).

The manner in which the deposition and post-treatment plasma is generated is not limited by Li in teaching that RF power can be "applied to the electrodes of a plasma reactor" and ICP can be employed. While Tsukune discloses applying RF power to the upper electrode, Tamura

discloses that it is conventional to apply RF power to the substrate holder electrode in conventional plasma-assisted CVD apparatus for forming silicon dioxide films. Domoto evinces the same RF power arrangement as Tamura. Thus, on this record, we agree with the Examiner that one of ordinary skill in this art would have a reasonable expectation of successfully using a plasma reactor with RF power applied to the substrate holder electrode in practicing Li's method. Such a reactor, of course, satisfies the requirement for the RIE plasma mode in claim 22, as we interpreted this claim above. We agree with the Examiner that the further combination of the ICP mode with the RIE mode specified in claim 26 does not distinguish the applied prior art because, on this record, the simultaneous application of several means disclosed in Li for the same purpose of disassociating gases into ions and radicals in the plasma reactor which would not conflict in operation would have been a modification suggested to one of ordinary skill in this art by the reference.

Turning now to the limitation that the dielectric constant of the processed layer is below 3.00 as specified in claim 14, we found above that Li would have taught that this property can be achieved by the process disclosed therein (*see above* p. 10). With respect to the formation of a processed layer having a thickness in the range of 7,000Å to 9,000Å specified in claim 21, we determine that the combined teachings of Li and Tsukune would have suggested to one of ordinary skill in this art that a layer of this thickness containing carbon can be prepared by Li's process as well as formed from layers prepared with alternating process steps as suggested by Tsukune (*see above* p. 12).

Accordingly, one of ordinary skill in this routinely following the combined teachings of Li, Tsukune, and Tamara and as further combined with Domoto would have reasonably arrived at the claimed method encompassed by claims 1, 14, 21, 22, and 26 without recourse to Appellants' Specification. *See, e.g., In re Keller*, 642 F.2d 413, 425, 208 USPQ 871, 881 (CCPA 1981) ("The test for obviousness is not whether . . . the claimed invention must be expressly suggested in any one or all of the references. Rather, the test is what the combined teachings of the references would have suggested to those of ordinary skill in the art.").

We are not convinced otherwise by Appellants' contentions. Indeed, one of ordinary skill in this art would have considered the teachings of each of Li and Tsukune as a whole as well as the inferences that can reasonably be drawn therefrom.[3] Thus, this person would have recognized from the teachings of Tsukune that the desired result of a carbon free silicon oxide layer is not readily attainable without practicing certain steps under conditions disclosed in the reference for removal of carbon. These teachings and the further disclosure that the organic component in one layer is "substantially zero," that is, not "zero," and the disclosure of other conditions which can readily result in retention of an organic component in the layer are evidence supporting the Examiner's position that it is difficult

[3] It is well settled that a reference stands for all of the specific teachings thereof as well as the inferences one of ordinary skill in this art would have reasonably been expected to draw therefrom, *see In re Fritch*, 972 F.2d 1260, 1264-65, 23 USPQ2d 1780, 1782-83 (Fed. Cir. 1992); *In re Preda*, 401 F.2d 825, 826, 159 USPQ 342, 344 (CCPA 1968), presuming skill on the part of this person. *In re Sovish*, 769 F.2d 738, 743, 226 USPQ 771, 774 (Fed. Cir. 1985).

to remove Si-C bonds from the silanol layer in forming the polysiloxane layer. There is no teaching in Tsukune that an H_2O plasma providing hydrogen ions and hydroxyl radicals, a H_2 plasma with H ions, an O_2 plasma providing O ions, or a combination thereof differ in result with respect to any combination of processing steps; the only differences being in the mechanism involved in removing organic groups. Accordingly, we are of the opinion that the teachings of post-treating the same and similar processing of the same or similar Si-C bond containing silanol films with O_2 plasmas in Li and the plasmas in Tsukune to obtain polysiloxane layers that can have some amount of carbon therein, however small, would have led one of ordinary skill in this art to reasonably conclude that a post-treatment of such films with any of the plasmas, including hydrogen plasmas, provide the same or similar results.

Accordingly, based on our consideration of the totality of the record before us, we have weighed the evidence of obviousness found in the combined teachings of Li, Tsukune, and Tamara and as further combined with Domoto with Appellants' countervailing evidence of and argument for nonobviousness and conclude that the claimed invention encompassed by appealed claims 1, 3, 5, and 10 through 26 through would have been obvious as a matter of law under 35 U.S.C. § 103(a).

We summarily affirm the ground of rejection under the judicially created doctrine of obviousness-type-double patenting advanced by the Examiner because Appellants have not addressed this ground in the Brief (Br. in entirety). *See* Manual of Patent Examining Procedure § 1205.02 (8th ed., Rev. 5, August 2006).

The Primary Examiner's decision is affirmed.

No time period for taking any subsequent action in connection with this appeal may be extended under 37 C.F.R. § 1.136(a)(1)(iv) (2006).

AFFIRMED

cam

Volentine & Whitt PLLC
One Freedom Square
11951 Freedom Drive Suite 1260
Reston, VA 20190